the optical constants of the alloys of copper and zinc, which cannot be given in an abstract.

6. In the details of the several experiments, the author calls attention to several remarkable laws, or indications of laws, which appear to him to require some notice from theorists.

a. When the azimuth of the incident beam is less than the circular limit, the axis major of the reflected ellipse, at the principal incidence, lies in the plane of incidence; but when the azimuth is greater than the circular limit, it is perpendicular to the plane of incidence, and as the incidence varies, the axis major twice approaches to a minimum distance from that plane.

b. There appears to the author to be some indication in the experiments on metals, that the quantity known to theorists as $\left(\frac{J}{I}\right)$ is not a function of the incidence only; a conclusion which, if correct, would require the intervention of a third wave suppressed, or some such theoretical supposition, to account for it.

XII. "On the Loess of the Valleys of the South of England and of the Somme and the Seine." By Joseph Prestwich, Esq., F.R.S. Received June 19, 1862.

(Abstract.)

In this paper the author takes up and discusses a point connected with the former inquiry, but postponed in the paper he read before the Royal Society in March last, a recent visit to France having led him to form a conclusion with regard to the origin of the Loess sooner than he then expected.

On that occasion he referred the loam and brick-earth, with land and freshwater shells, which occurs in the valleys and on many of the hills in the South of England and North of France, to temporary inundations of the old rivers. On the present occasion he shows that this deposit is intimately connected with the origin of the river-valleys and with the fluviatile high- and low-level gravels described in his last paper.

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Reference is first made to the Loess of the valley of the Rhine, and the author accepts Sir Charles Lyell's explanation that it is the result of a river-deposit; but he does not agree in the explanation as to the mode which led to the actual results, so far as the present district is concerned.

One difficulty in understanding the spread of the loess in England and France has always been the greatly different levels on which it occurs, being present in the bottom of the valleys, and occurring on ground 100, 200, and 300 feet higher. This evidently places it beyond the reach of inundations with the valleys formed as they are at present, and the prior origin of which the common covering of loess might lead one at first to infer. But if, instead of starting at the present low levels, the valleys be taken at the level the author showed them to have had at the period of the upper high-level gravels, it will give a base for the original river-levels of 100 to 200 feet above the existing valleys, and therefore it will reduce the difference of level of the higher deposits of loess to be accounted for, to 100 or 150 feet. In many cases it is less, but it is still considerable. It thus brings the whole of the loess within the possible range of inundations of the old Post-pliocene rivers at different periods of their age; the higher beds of loess having been deposited during floods at an early period, and before the excavation of the present river-valleys, and the lower beds having been deposited after the excavation of the valley, and while some of the old meteorological conditions still prevailed.

The author shows that the loess is, in fact, like the high- and low-level gravels, always connected with river-valleys, although it extends much beyond the limits of these beds, rising to much higher levels, and extending far beyond their limits. He then shows that in the valley of the Somme, the difference between the highest levels of the loess and the upper gravels thus becomes reduced to 60 or 80 feet; in the Oise, to apparently about 50 feet; in the Seine valley, to about 120 to 150 feet; and in the Bresle valley to 70 feet.

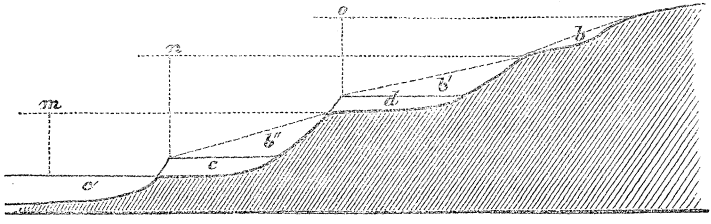
The loess contains the same mammalian remains and the same species of land mollusca as the gravels. Of freshwater mollusca it contains hardly any.

Notwithstanding the extension of the loess over the higher grounds flanking the river-valleys, still such grounds are always bounded by

higher hills, which seem to have formed barriers to its further spread. It seems, therefore, that although the connexion of these several and distinct deposits is, owing to their irregular and wide spread, not always apparent, it is probable that they are related to the same phenomena, and that they present two phases of causes having a common and contemporaneous origin.

In all rivers subject to floods, three forms of sediment will be deposited: first, gravel and shingle in the more direct channel; secondly, sand in the more sheltered places; thirdly, fine silt where the flood-waters are at rest out of the direct channel.

In such manner the author conceives the high- and low-level gravels and the loess of all the levels to have been formed.



b' b' b''. Representing the Loess.
d. A high-level gravel.
c' c'. Lower-level gravel.
m, n, o. The levels to which the river rose during inundations at different periods.

If, therefore, the flood-water origin of the loess be admitted, it follows that, as it is found rising from 50 to 100 feet above the highest bed of the fluviatile gravels which mark the channels of the old rivers, it gives a measure of the magnitude of the floods of that period, showing that they rose at times 50 to 100 feet above their summer low levels; like, in fact, the rivers in arctic regions, but to a greater extent. Such conditions show their great erosive power, and furnish the evidence wanting on the former occasion to prove that such greater power had existed. Though a greater rainfall was inferred from other causes, this more direct evidence was wanting.

The author mentions his discovery, on the occasion of his last visit to Paris, of freshwater shells of the genera *Limneus* and *Valvata* at two places in the low-level gravels of Paris, and again at Rouen. He also gives a section of some remarkable contortions, which he refers to ice-action, in the high-level gravel of Charonne.

The fluviatile origin of the different gravels, as well as the greater action of ice at the higher levels, is therefore confirmed, as is also the suggestion that the volume of water carried down at the period in question by the rivers was infinitely greater than it now is. At the same time the view now given both explains the origin of the loess, so long an unsettled problem, and harmonizes with the hypothesis before advanced in explanation of the accompanying general phenomena.

XIII. "On the Simultaneous Distribution of Heat throughout superficial parts of the Earth." By Professor H. G. Hennessy, F.R.S. Received June 19, 1862.

(Abstract.)

The principal object of this memoir is to develope the laws of the distribution of temperature in the portion of the atmosphere in contact with the earth, and to point out the connexion between the phenomena of aërial temperature and those of soil and oceanic temperature. The author maintains that hitherto no perfect physical representation of the distribution of heat over the earth's surface has been obtained. Humboldt's luminous method of representing the distribution of mean temperatures necessarily presents us with the temperatures of places at those hours of local time when the temperature happens to be equal to that of the entire day. But such hours occur at different places not at the same moment of absolute time, and therefore the isothermal lines traced by the aid of their results alone, are not true isothermal lines in the same sense as we understand an isothermal line or surface within crystals, or other definite geometrical solids which have been recently the subjects of thermological inquiry.

The distribution of sunshine at the outer limits of the atmosphere and at its base is first considered, and the nearly circular shape of the lines of equal sunshine is pointed out. After showing the connexion between these lines and the simultaneous isothermals for the air, land, and water, the author proceeds to more particularly discuss the aërothermal lines. As the term isothermal line has become universal in the sense of a line joining places possessing the same mean temperatures, the author proposes to designate the true lines of si-